

Intelligent Biology.

Why are we integrating now— and how can we integrate better?

History, complexity and metacognition

Report for the Strategic Multilayer Assessment Office

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Abstract: Integrating effectively has always provided a strategic edge, from the ancient world to the present day. Integration is a central theme of the 2022 National Defense Strategy. Here we ask: *Why is the United States seeking to integrate now—and how can it integrate better?* Now, for the first time since winning the Cold War, the United States must respond to a competitor strong across all levers of power—and so if it wants to compete it must integrate for the character of our new era of competition. This report traces integration as a strategic edge from the 1500s to the present, to identify key themes for the success (or failure) of US integration in the 2020s and 2030s. Three overarching sets of issues emerge: integration militarily; integration across multiple sources of power; and civil-military integration within the state. Integrating with allies and integrating technology will also be key for the United States. All are complex, so to help make them more tractable for practitioners we introduce simple concepts to deal with complex environments (e.g. the “adjacent possible”). We also introduce a powerful new field of cognitive science (metacognition or “thinking about thinking”) that can give the United States an edge for developing the humans, and human-machine teams, that will always lie at the heart of integrated US power.

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This report is one of a coherent family of *Intelligent Biology* products that provide a framework for successful influence across the spectrum of competition, from gray zone to war. All are available www.intelligentbiology.co.uk, including:

- Wright, ND (2019, v3) ***From Control to Influence: Cognition in the Grey Zone***, Intelligent Biology.
- Ed. Wright ND, (2018) ***AI, China, Russia and the Global Order: Technological, Political, Global, and Creative Perspectives***, U.S. Dept. of Defense Joint Staff.

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Contents

INTRODUCTION	2
PART ONE. A HISTORY OF INTEGRATION FROM THE 1500s TO THE PRESENT DAY	3
(1) From non-human primates to Rome: specialization and integration	3
(2) Integrating from Maurice to Napoleon: amplifying power via military, administrative, global and total integration	4
(3) Prussia responds to the French Revolution and Napoleon—the General Staff	5
(4) Britain—a democracy's responses to twentieth century wars	7
(5) Interwar German and French responses—Blitzkrieg and Maginot	8
(6) The United States responds to World War Two and the Cold War	9
(7) China responds to Soviet Collapse—Comprehensive National Power	10
PART TWO. INTEGRATION NOW: US RESPONSES FOR OUR NEW ERA	12
The adjacent possible, leadership, and the myth of the master strategist	13
Building a cognitive edge: metacognition	15
REFERENCES, ENDNOTES AND FURTHER READING	17

INTRODUCTION

Integrating effectively has always provided a strategic edge, from the ancient world to the present day. In the early Cold War, for example, the United States faced the highly capable Soviet Union: a competitor operating across the diplomatic, military, economic, intelligence and technological spheres; and whose military had learned to integrate combined arms in the crucible of German *Blitzkrieg*. In response, the United States developed new ways to understand and act in this complex Cold War environment: the National Security Council's 1947 founding Act specified its role as "integration"; and militarily the United States created, for the first time, an integrated institution that combined the Departments of War and Navy. Now, integration is a central theme of the 2022 National Defense Strategy (NDS).ⁱ Thus, here we ask: *Why is the United States seeking to integrate now—and how can it integrate better?*

For millennia integration has been a key edge for powers that successfully respond to external challenges, although the character of integration changes over time. Now, for the first time since winning the Cold War, the United States must respond to a competitor strong across all levers of power—and so if it wants to compete it must integrate for the character of our new era of competition.

China uses economic, technological and diplomatic power to build positions of strength so it can win without fighting. Militarily, China strives for joint integration of new space, missile, cyber, artificial intelligence (AI) and quantum—and just as interwar German combined arms overtook the British and French, China could in the near future integrate better than the United States.

This report traces integration from the 1500s to the present, to identify key themes for the success (or failure) of US integration in the 2020s and 2030s. Three overarching sets of issues emerge when considering integration as a strategic edge:

Military integration, which can be decisive in battle. Consider interwar developments that later revolutionized warfare in World War Two. On land, Germany developed the *Blitzkrieg* whose combined arms and air-ground integration would, in May 1940, defeat larger allied forces. At sea, the US and Japanese navies' integration of aviation would help make carriers the primary instrument for delivering naval combat power in World War Two. In the air, Britain's Royal Air Force (RAF) Fighter Command built the world's first integrated air defense, which would win the Battle of Britain: Hitler's first major defeat. But there is more to integration than just the military.

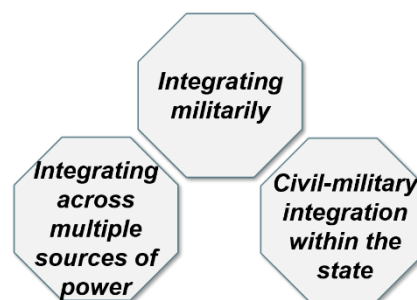
Integration across multiple sources of national power can also be crucial. Britain responded to World War One by creating the Cabinet Office and other integrative institutions that, with adaptations, have served it well until the present day. In response to the Cold War, the United States developed integrative bodies like the National Security Council (NSC). China responded to the Soviet Union's collapse, which threatened their own regime, through a focus on developing Comprehensive National Power at home and using that power abroad to outflank its competitors.

Civil-military integration within the state can be central to victory and defeat. One challenge is to prevent a domestically over-mighty military that can lead to bad strategy, or even destroy a political regime—a problem in twentieth century

Germany. Lack of robust, specialized civilian counter-weights to the German military led to the inflexible war plans that contributed to the outbreak of World War One—and during that war contributed to German unrestricted submarine warfare that, although perhaps an acceptable military risk, was a predictable geopolitical disaster, not least by precipitating US entry into the war. The German military’s inter-war domestic machinations and attitudes helped Hitler’s rise to power. And the problems are not only German but also contributed to the Cold War’s outcome: while the US President Eisenhower warned of the “military-industrial complex”, the Soviet Union’s military absorbed such a vast chunk of national resources that it became unsustainable over the long haul. Yet a second challenge comes not from a domestically over-mighty military, but instead from damaging political interference in professional military matters that can corrode military effectiveness—a problem in interwar France.

Considering these types of integration together can help practitioners see the big picture on “integration.”

Part One of this report outlines this big picture by tracing the history of integration as a strategic edge. The report is written concisely for practitioners with further reading confined to the endnotes—and as each new aspect of integration emerges we highlight specific implications for the United States in the 2020s and 2030s.



Part Two then considers what successful integration looks like for the US now, and offers fresh, operationalizable ideas for how to achieve it. All these types of integration are complex, so to help make them more tractable for practitioners we introduce simple concepts to deal with complex environments (e.g. the “adjacent possible”). We also introduce a powerful new field of cognitive science (metacognition or “thinking about thinking”) that can give the United States an edge for developing the humans—and human-machine teams—that will always lie at the heart of integrated US power.

PART ONE. A HISTORY OF INTEGRATION FROM THE 1500s TO THE PRESENT DAY

(1) From non-human primates to Rome: specialization and integration

Specialization is the process by which individuals, groups or other entities become expert in a particular function or skill, or adapted to a particular environment. Non-human primates show limited specialization amongst their own species except by sex and age, while human hunter-gatherers show more. But it is once civilizations emerge that specialization between humans really takes off: scribes, warriors, blacksmiths, and so on. Then, amongst warriors specialists can arise in various types of combat.

Integration is needed to coordinate these specialists, which can occur by markets,

formal or informal institutions, or in myriad other ways. *Integration is the process of combining things in a single larger system.* Integrating in new ways provides an edge, and also enables new specializations, which in turn enable new types of integration and so on. In fields from economics to the military, this dance of specialization and integration has continued to the present day.

By the time we reach an advanced civilization like Rome, three overarching sets of issues emerge when considering integration as a strategic edge:

(1a) Integrating militarily. How to integrate types of warriors (e.g. cavalry, infantry), and at large scale (e.g. legions with identities and centurionates)?

Implications for the 2020s/30s: Build jointness, including integration of new specialized domains like space and cyber. Also integrate new military technologies like AI and quantum within domains.

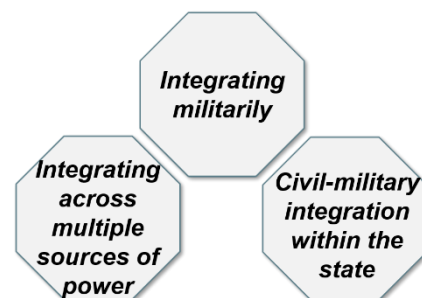
(1b) Integrating across multiple sources of power. How, for example, to harness and use the diplomatic and military tools of Roman provincial governors?

For the 2020s/30s: In modern US parlance, e.g. how to use “DIME” to affect “PMESII.”¹ The SMA project on Anticipating the Future Operational Environment (AFOE), for example, aims to understand this environment, and so identify leverage points on which to act via “integrated deterrence” and other integrated means that are a focus of the 2022 NDS and the Joint Concept for Competing.ⁱⁱ

(1c) Civil-military integration within the state. How does one build a capable military that also serves, rather than becomes master of, its state? The Roman Republic thrived for some four centuries, winning titanic wars against adversaries like Carthage. But Rome’s generals assumed ever greater domestic political power—from Marius to Sulla, Pompey and Julius Caesar—until the Republic fell under Augustus. And even then, Imperial Rome was soon plagued by the machinations of the Praetorian Guard.ⁱⁱⁱ

For the 2020s/30s: “Political power grows out of the barrel of a gun” Mao Zedong famously noted, and “the gun must never be allowed to command the Party.” Civilian control of the military is a challenge for all modern regimes. The challenge for the United States is maintaining and adapting an effective, professional military *and* one that does not corrode or threaten US freedom and democracy.^{iv}

These remain the three overarching sets of issues to this day. For the sake of brevity we take up our story again in the 1500s, when the first armies emerged that Alexander the Great would not have known how to command.



(2) Integrating from Maurice to Napoleon: amplifying power via military, administrative, global and total integration

Rediscovering “Roman” ideas of discipline in the late 1500s enabled a “first military revolution.” From then upto the Battle of Waterloo in 1815, four types of

¹ DIME are the Diplomatic, Information, Military, and Economic levers, which have Political, Military, Economic, Social, Information, and Infrastructure (PMESII) effects.

integration amplified European states' strategic power.^v

(2a) Integrating militarily^{vi}: Maurice of Nassau (1567-1625) and Gustavus Adolphus (1594-1632) created troops and units disciplined enough to integrate into a unified whole under a commanding will—for the first time since antiquity, but now bigger and with new technology like cannon in the combined arms.

For the 2020s/30s: Key will be to enhance how integratable people and tech are, so that they can be successfully integrated, e.g. in DARPA's "Mosaic" or "JADC2."

(2b) Integrating administratively^{vii}: Under Louis XIV (1638-1715), France's new administrative machinery integrated societal resources into the national military effort to vastly increase military power.

For the 2020s/30s: Innovative dual use, commercial resources will be key—for which China pioneers "civil military fusion."

(2c) Integrating globally^{viii}: In the Seven Years' War (1754/6-63) Britain beat the regional superpower, France, using allies and by winning the first truly global war.

For the 2020s/30s: The global dimension has been crucial for all generalized great power confrontations since, e.g. 1793-1815, the World Wars and Cold War.

(2d) Integrating mass politics for total war^{ix}: In the French Revolutionary and Napoleonic Wars (1793-1815) new mass patriotic politics mobilized vast human and other resources for integration into more total war.

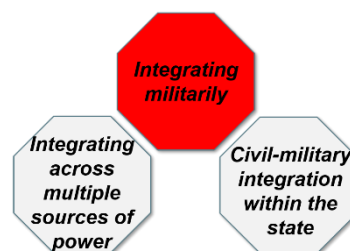
For the 2020s/30s: All great powers in subsequent generalized wars needed mass patriotic politics to compete—but this can let authoritarian genies, such as Napoleon, out of bottles.

European states, and offshoots like the United States and Russia, became far more powerful than before—but they still faced the overarching challenges of integration that Rome faced (military; multiple sources of power; and civil-military).

The next four cases take us up to the present day. Crucially they also show how countries can use integration to *respond* to external pressures—because the United States must now respond to China's rise and a return to multipolar global competition.

(3) Prussia responds to the French Revolution and Napoleon—the General Staff

Prussia was catastrophically defeated by Napoleon's forces at the battle of Jena in 1806. In response, Prussia developed the General Staff, the most significant military innovation of the nineteenth century. While Napoleon's individual genius enabled him to integrate huge, distributed armies in his own head, the Prussian (and later German) General Staff developed the elite officers and administrative processes that could perform these feats with non-geniuses. It developed over many decades, in particular under its Chief Helmuth von Moltke (1800-91), and the Prussian victories over Austria in 1866 and France in 1870 made it a model that every other power had to copy in order to compete.^x



Implications for the 2020s/30s are clarified by comparison to the three overarching sets of issues described above since Rome:

(3a) The General Staff was excellent for integrating militarily and its strengths remain necessary for any excellent military now.

Crucial were the people it produced: highly professional, learned and reflective officers (relative to their competitors), which are all qualities the United States can now emulate to obtain a cognitive edge (see below on metacognition; and of course other aspects of such Prussian/German officers are not at all admirable). The General Staff also showed that integration of effort need not mean centralization: it decentralized command in key ways that later morphed into German *Auftragstaktik* and US ideas of mission command. Further, it rigorously integrated key new technologies, notably railways.

(3b) A military staff alone, even a very effective one, cannot integrate across the relevant multiple sources of power—and particularly the international political aspects.

The General Staff's professional focus and expertise was on military rather than political or diplomatic effects. Prussian success in 1866 and 1870 rested on the combination of the military General Staff under its Chief Helmuth von Moltke *plus* Otto von Bismarck who led on international politics.

(3c) Civil-military integration within the state was unbalanced due to later civilian weakness.

Germany in the late nineteenth and first half of the twentieth century increasingly lacked robust civilian bodies to balance and subordinate the military.

- This contributed to World War One's outbreak in multiple ways, including: (i) the General Staff's "Schlieffen Plan" virtually guaranteed a two front war that in turn risked a more general war; (ii) when in 1913 they ended the only alternative war plan (that included a war against Russia while France remained neutral) this left no alternatives to the Schlieffen Plan; and (iii) in the last crisis days before war broke out they refused to alter their war plans to exclude France.^{xi} As the historian Margaret MacMillan put it^{xii}, "The civilian leaders, for their part, accepted the artificial distinction insisted upon by the military leadership that they had exclusive jurisdiction in all matters military, from war planning to the conduct of the war itself... [e]ven when the decisions being made by the military had political or international impact" like the violation of Belgian neutrality that in 1914 brought Britain into the war. Effective strategy needed civilian expertise as much as it required effective military expertise.
- Lack of civilian power to balance the military also contributed to Germany's loss of World War One. Unrestricted submarine warfare, for example, may have been an acceptable military risk but was a predictable political disaster as it brought the United States into the war.^{xiii}
- In interwar Germany the military's machinations and attitudes also aided Hitler's rise to power. Former German General Staff Officer Kurt von Schleicher was the last German Chancellor before Adolf Hitler, and former Chief of the General Staff Paul von Hindenberg who was German President from 1925-1934.

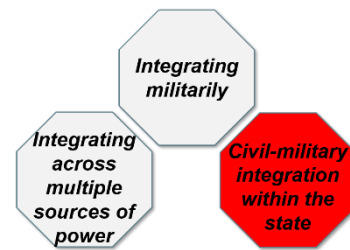
In sum, the General Staff was a very powerful tool every great power needed (and still needs now), but alone it can only ever be part of the answer for strategic effectiveness. Moreover, an over-mighty military unbalanced by robust specialized civilian institutions can corrode and destroy effective civil-military specialization and integration within the state—and so even destroy democracy itself.

(4) Britain—a democracy’s responses to twentieth century wars

Britain was the only sizeable power to fight for years in both World Wars without losing—and yet despite a century of challenges that required powerful integration, its democracy was not just sustained but deepened. How?^{xiv}

(4a) Balance between robust civilian and robust military integrative bodies.

It built powerful integrative military bodies—like the General Staff after failures in the Boer War (1899-1901) and a joint body of army, navy and air Chiefs in 1923 (on which the United States based the Joint Chiefs). But crucially these were always subordinate to civilian masters, and also balanced by the building of powerful new specialized civilian integrative bodies, like the Cabinet Office in World War One.



For the 2020s/30s: A more powerful and integrated military is a laudable aim and it should be balanced by enhanced civilian integrative bodies, like the US NSC, that are given the bureaucratic heft and levers to balance the military.

Britain also went further in three significant ways.

(4b) Deep allied integration was baked into its DNA. Australia, Canada and other Commonwealth countries always influenced decisions. In World War One Britain allowed French Supreme Command of its Western Front army; in World War Two it formed the Combined Chiefs of Staff with the United States based in Washington; and in the Cold War integrated deeply with NATO and the Five Eyes. If Germany, for example, had collaborated even a fraction as well after 1940 with Japan, Italy and Fascist Spain it would likely have won.

For the 2020s/30s: The most trusted allies matter deeply, and that requires the confidence to compromise with allies.

(4c) Integration of technology. The Royal Navy had long integrated new technologies with an alacrity similar to the Prussian use of railways, as illustrated by the 1906 launch of the Dreadnought that rendered all other battleships obsolete. But the UK went further. The Royal Air Force (RAF) was a genuine separate service from 1918, and its Chief sat alongside the army and navy on the joint committee formed in 1923. RAF Fighter Command formed in the interwar years was the first integrated air defense system and in 1940 won the Battle of Britain.

For the 2020s/30s: Cyber and space must be genuinely empowered.

(4d) Integration of civil and military in counter-insurgencies and small wars.

During the Cold War Britain had unusual success among Western powers (e.g. against the early 1950s Malayan Communist insurgency) unlike France (e.g. in Algeria or Vietnam) or even the United States (e.g. in Vietnam). However, Britain’s

watershed failure over Suez in 1956 was a political failure in Washington DC, not a military failure in the Middle East.

For the 2020s/30s: Politics must be baked into strategy at every level, from top to bottom.

Yet while history's long arc may tend to democracy, the short term can be fatal because integration by even the most appalling authoritarian powers can be superior in significant ways. The British Army had pioneered the tank, but in the interwar years fell behind German integration in combined arms on land: with terrible results in May 1940. The danger appears even more starkly when comparing integration by interwar Germany and France.

(5) Interwar German and French responses—Blitzkrieg and Maginot

Germany lost World War One and France won. But their contrasting responses to that war and the interwar years help explain France's catastrophic defeat in 1940.^{xv}

France's greater democracy, while of worth in itself, did not ensure victory. France had been a democracy since 1871, albeit fragile during periods like the interwar years. Germany had its first ever interlude of enfeebled democracy from 1919-33, and even then its President from 1925 onwards was the former World War One Chief of the German General Staff Paul von Hindenburg. And, of course, Hitler's lack of democracy was sadly no bar to aspects of highly effective integration.

(5a) German integration succeeded at key levels. Militarily Germany pioneered new combined arms methods on land, and also joint land and air operations. Germany also integrated well across multiple sources of power, notably integrating political objectives with military means in the interwar years and early part of the Second World War (it was expansionist). In terms of civil-military integration within the state, civilians had only been tentatively on top in Germany's fledgling democracy—and the military facilitated Hitler's rise to power and he then coopted and subjugated the military to his will. As a warlord, Hitler integrated martial values throughout society, and integrated his political ideas into the military. Earlier in World War Two, specialized military advice was still taken, such as Erich von Manstein's "sickle cut" that smashed the French armies in May 1940. As the war progressed Hitler assumed ever more direct military control. Later in World War Two the lack of an effective military counterweight to his political power contributed to strategic failures (e.g. frequent refusals to allow retreats such as in Stalingrad or Tunisia) but this came years too late to help France.

(5b) French integration sadly failed at almost every level. Militarily, French combined arms and joint air-land operations were markedly inferior to the German *Blitzkrieg*. Its air forces failed to integrate new technology into strategy, unlike the British. Its grand strategy failed to integrate political ends and military means—a highly defensive French military doctrine was inadequate to support the French alliance system in which Germany could defeat allies in Central Europe with no French offensive threat. Finally, military decision-making was slow because the military establishment was a foreign body inside the Third Republic, so the high command protected itself from political constraints by sheathing military functions

(e.g. supply and intelligence) in bureaucratic silos.

Implications for the 2020s/30s: Democracies are not necessarily better at integration, and in our new competitive era the United States will not integrate better than China just because it is a democracy any more than France integrated better than Germany.

But the United States has integrated brilliantly before.

(6) The United States responds to World War Two and the Cold War

When Japan attacked Pearl Harbor on December 7, 1941 and Germany declared war on the United States four days later, the United States lacked both the whole of government and the joint military decision-making institutions to fight back effectively. But it responded with remarkably rapid and successful integration, which was carried over into the Cold War in response to Soviet power. Two time periods were key.

(6a) 1941-1953: The Joint Chiefs, National Security Act and New Look—balance between robust civilian and robust military integrative bodies.^{xvi} The United States built a system with a similar character to the British system, albeit tailored to the US constitutional setup. Indeed, voices in Congress spoke against a more unified and powerful “Prussian-style general staff.” The US Joint Chiefs, for example, were originally set up to mirror their British “opposite numbers” in the British Chiefs of Staff Committee and together make up an Anglo-American Combined Chiefs of Staff. Allies were thus also integrated from the beginning. So too was the imperative to integrate new technology, which in the early Cold War included momentous new nuclear technologies. The NSC not only helped integrate across multiple instruments of power, but also constituted a robust civilian body.

(6b) 1979-86: The rise of Jointness.^{xvii} The United States had another period of significant reform with the rise of Jointness. Although occurring in the context of Cold War competition and partially in response to perceived problems arising in Desert One (1980), Grenada (1983), and Beirut (1983)—strikingly this reform was at least in part internally driven from within the United States. Specifically, it was largely driven by the legislature against the desire of many in the military and the executive. Perhaps most importantly it shows the US can go beyond adapting others’ models—such as the Prussian (for the US Army General Staff in 1903) or British systems (e.g. for the US Joint Chiefs)—to pioneer advances that have likely been highly effective^{xviii}, and are centered on integration. Finally, these reforms had key human dimensions, with the creation of a principal military advisor to the President, and changes to officers’ career incentives to become more genuinely “joint.”

Implications for the 2020s/30s: The United States won both World War Two and the Cold War against highly capable adversaries who wielded integrated power. It also ensured that a mighty military was balanced domestically by powerful civilian institutions—so it could prevail, in President Eisenhower’s phrasing, over “the long haul” without becoming a “garrison state”. This required active institutional innovation, which will be required once again in our new era.

But whilst for the United States the 1991 Soviet collapse meant they had won the Cold War, it meant something very different in China. There it was a profound external shock that threatened the regime, and even the lives of leaders who had watched Romanian Communist leader Nicolae Ceausescu's execution. Moreover, in the first Gulf War that year the Soviet collapse coincided with the stunning US defeat of Iraqi forces of similar quality to China's own. How did China respond?

China responded effectively, not least through an integrated view of the multiple components of national power.

(7) China responds to Soviet Collapse—Comprehensive National Power

"It's hard to overstate how obsessed they are with the Soviet Union," noted scholar David Shambaugh who extensively studied how the Chinese Communist Party (CCP) adapted to the Soviet collapse.^{xix} It was perceived that loosening too far, the Soviet communist party itself collapsed, which led to the country's collapse and the loss of territories like Ukraine. Xi Jinping gave a private speech in December 2012, shortly after assuming power, blaming the Soviet collapse on officials who strayed from their ideological roots. "Why must we stand firm on the party's leadership over the military?" Xi asked. "Because that's the lesson from the collapse of the Soviet Union. In the Soviet Union, where the military was depoliticized, separated from the party and nationalized, the party was disarmed."

Shambaugh also describes how they concluded that two principal reasons for the Soviet collapse were overspending on defense and distortion of the national economy in favour of the military-industrial complex. The CCP wished to avoid such failure. Instead, he argues they believe "it is important to build and cultivate power comprehensively across a variety of spheres: the economy, science, technology, education, culture, values, military, governance, diplomacy, and other sectors. The Chinese grasp the idea that power is comprehensive and integrative, not atomistic." Thus, a recent RAND report labelled China's grand strategy for over a decade after the 1991 shock as "Building Comprehensive National Power" (CNP).

How China sought to integrate after the Cold War's end can be understood by using the three overarching sets of issues for integration described above:



(7a) Integrating militarily. Coupled with the shock of the 1991 Gulf War against Saddam Hussein^{xx}—when the United States completely outmatched forces technologically similar to China's own—the end of the Cold War led China to pursue both jointness and integrated defensive systems often described as anti-access/area-denial ("A2/AD"). China was no longer aligned with the United States against the now defunct Soviet Union, and would need to innovate to be able to defend itself. As the *PLA Encyclopedia* notes, the first Gulf War showed the importance of coordinated operations among different services, and deep attacks in the rapid attainment of campaign objectives.^{xxi}

(7b) Integrating across multiple sources of power. Unable to compete head-to-head with the United States militarily, China sought ways to use other levers of

national power to influence others. David Kilcullen described this as “conceptual envelopment.”^{xxii}

(7c) Civil-military integration within the state. The People’s Liberation Army (PLA) has long managed a tension between being “Red” (politically reliable) and “Expert” (taking a professional approach that employs regularized tactics and integrates technology)—and after 1991 they concluded both were needed.^{xxiii} The CCP maintained control of the military, for instance imposing relatively tight spending constraints.

Implications for the 2020s/30s: Such integration after the Soviet collapse succeeded for the CCP, albeit as a work in progress. A recent RAND study on China’s grand strategy after 1949 argued that the “Building CNP” phase lasted from 1990-2004, followed by an increasingly assertive grand strategy of “Rejuvenation” to the present day. This assertiveness reached a new pitch in the years after Xi Jinping assumed power in 2012. Supporting such grand strategy, Chinese integration has continued along its successful trajectory to the present and looks set for the 2020s and 30s:

Integrating militarily for the 2020s/30s.^{xxiv} The CCP’s focus is on making steady progress toward joint operations, with the missile, maritime, and strategic support forces being given priority over the ground force. RAND anticipates this will increase costs to the US for Indo-Pacific contingencies by 2035 (if not before). The most impactful of the new-type combat forces will probably result from the formation of the Strategic Support Force (SSF), founded in 2015 as China’s first large, permanent joint organization of operational forces that integrates People’s Liberation Army (PLA) Army, Air Force, Navy, and Rocket Force elements. The SSF integrates many intelligence, space, cyber, and electronic warfare capabilities. Reforms balance this enhanced integration by also enhancing specialisation, for example by establishing a separate service status for the PLA Rocket Force (formerly the 2nd Artillery Force) in a move reminiscent of Britain’s early founding of the RAF, and by defining the unique roles of the Central Military Commission (CMC) services. Leaders also plan to integrate new technologies like hypersonics, rail guns, and cyber and network operations.

Integrating across multiple sources of power for the 2020s/30s. Examples here include extensive programs for “Civil Military Fusion” in innovation and technology, or the vast multidimensional “Belt and Road” schemes at global scale. It is also building its partnership with Russia.

Civil-military integration within the state for the 2020s/30s. The Party continues to hold the gun. Continuing restructuring is centralizing the PLA’s Command and Control (C2) structure and streamlining bureaucracy. As RAND^{xxv} notes: “The new structure is also supposed to strengthen CCP control of the military and will almost certainly make it easier for the civilian chairman of the CMC—Xi Jinping and his successors—to wield influence over the PRC’s massive military establishment.”

In sum, China has emerged as capable and willing to compete with the United States in many arenas of power, and it is now pushing at the frontiers of integration.

PART TWO. INTEGRATION NOW: US RESPONSES FOR OUR NEW ERA

The world entered a new historical era around 2014.^{xxvi} That year marked Russia's invasion of Ukraine, the first seizure of territory in Europe since the end of World War Two. 2014 also fell midway between 2012-2017 during which Chinese President Xi Jinping reoriented his country's foreign policy. This new era of global, grey zone competition between great powers is not the Cold War, nor the Twentieth Century in which democracies twice faced authoritarian Germanies in World Wars, nor the two decades of conflict in which Napoleon sought European hegemony.

In our new era integration will remain crucial. But the character of the technologies, great powers, global systems and speed of change are different. Thus the character of integration will change.

So, in this new era, what does successful US integration look like?

The United States and China are both integrating for this new era, but each in their own ways. China is a land-based power with no deep network of alliances; the United States is protected by seas and a network of alliances. The United States is a democracy; China is authoritarian. The United States is at the frontier of many areas of expertise; China is more often still catching up. The United States lacked the externally-imposed discipline of a highly capable great power competitor during its unipolar moment from around 1991-2014; China did not.

Despite these differences, both countries will need success in the three overarching sets of issues described above for integration as a strategic edge. Both must also integrate new technologies. And the United States must also continue to harness the integration with allies, which will give it the global scale to compete over the long-haul with a country that has four times its population. US success thus involves five areas:

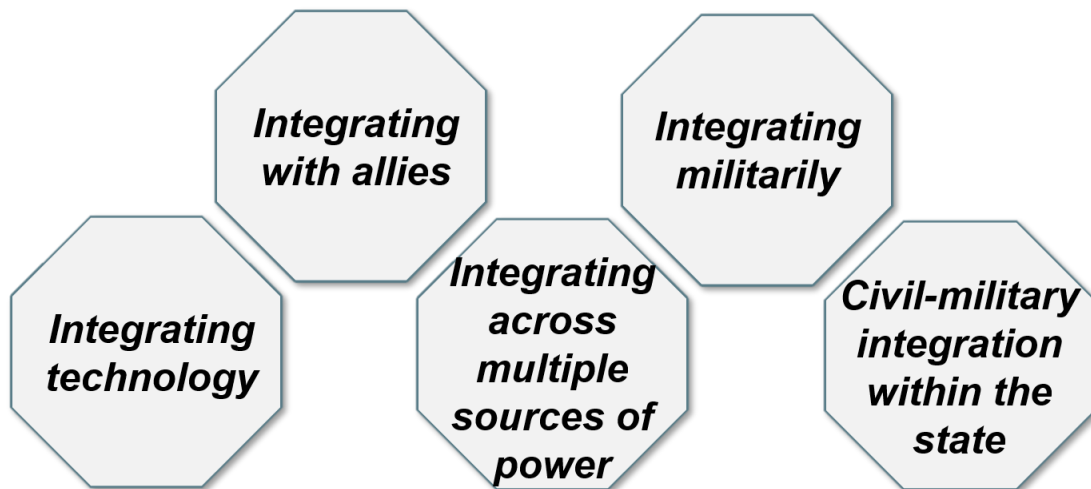
Integrating militarily. Pioneer new ways to build specialized forces (e.g. using cyber, space, AI, quantum) and integrate those specialized forces (e.g. jointness with new domains and technologies)—and do so at scales from the tactical to the global.

Integrating across multiple sources of power. Reinvigorate existing integrations (e.g. the NSC and inter-agency) and create new ways to integrate specialized diplomatic, informational, military, economic, technological, digital and other sources of national power—acknowledging that while this is vital to create strategic advantage, it is unlikely to be decisive except over the “long haul.”

Civil-military integration within the state. Robust and specialized civilian bodies like the NSC and State Department will be crucial to counterbalance a robust, professional and specialized military—and moreover the ultimate civilian authority of President, legislature and law must remain on top. President Eisenhower warned in his 1961 farewell address of the perils of “military-industrial complex”, which must be considered afresh for a modern democracy.

Integration of technology. Militarily, new domains like cyber and space must be both genuinely empowered and integrated with land, sea and air. The US military must find ways to integrate crucial technologies increasingly developed by civilian organisations like Google or SpaceX.

Allied integration. Reimagining integration with allies will be crucial to compete at global scale, for example in the military, in innovation, and in trusted supply chains.^{xxvii}



Each set of issues is a complex challenge that requires multiple trade-offs—and because US success involves all five that makes it even tougher. Twentieth Century Germany and France, for example, both failed. But the United States has succeeded before and can do so again. Thus, the final question this report asks is:

What kind of strategies—and strategists—can help achieve such success?

A first part of the answer is that the history of integration contains valuable insights. Part One of this report contains specific implications for the 2020s and 30s.

A second part of the answer is to introduce concepts that help simplify such complex challenges for practitioners (e.g. the “adjacent possible”). That is in the next section.

Finally, people have always been crucial for successful integration: from Roman Centurions; to Gustavus Adolphus’ disciplined troops; to the Prussian General Staff; or the modern day US Joint Staff. Thus, here we introduce a powerful new field of cognitive science (metacognition or “thinking about thinking”) that can give the United States an edge for developing the humans, and human-machine teams, that will always lie at the heart of integrated US power. This is described in the final section.

These last two sections seek to provide fresh, operationalizable ideas.

The adjacent possible, leadership, and the myth of the master strategist

“No plan of operations reaches with any certainty beyond the first encounter with the enemy's main force.”

“Strategy is a system of expedients; it is more than a mere scholarly discipline.”

—Helmuth von Moltke (1800-91) pioneer of military integration and Chief of the Prussian and German General Staff (1857-1888)

“crossing the river while feeling the stones one by one.”

—Deng Xiaoping (1904-1997), architect of China's post-Mao rise and paramount leader (1978-1992)

In his book *Strategy* (2013), Lawrence Freedman concludes his history of strategies of force with a chapter entitled “*The Myth of the Master Strategist*”. He takes issue with exalted views of a strategist as someone who can view both the system as a whole, and simultaneously view all of the many potentially vital factors (from ethics to economics) and their interdependencies. That is, a human’s ability to integrate is sorely limited.

Instead, Freedman notes that strategists must often improvise responses to unanticipated events; place some boundaries on their deliberations in order to understand and act; and know that adversaries often adapt to shocks. Thus, defining strategy as the art of creating power, he describes how:^{xxviii}

“As a practical matter strategy is best understood modestly, as moving to the next stage rather than to a definitive or permanent conclusion. The next stage is one that can be realistically reached from the current stage. . . . This does not mean it is easy to manage without a view of a desired end state. Without some sense of where the journey should be leading.

Put another way, to understand and act in complex environments that require integration, US strategy must contain both bottom-up appraisals of what is possible, *and* top-down visions of where one might wish to go.

For the bottom-up part, a useful concept is the “adjacent possible” introduced in the 1990s by scholar Stuart Kauffman.^{xxix} The adjacent possible can be described as the imaginative exploration of what is possible next given what exists now, or defined as the set of possibilities available to individuals, communities, institutions, organisms, productive processes, etc., at a given point in time during their evolution. This provides structured ways to think through complex problems, and SMA has recently applied it to complex, dynamic challenges like escalation management in 21st century information operations.^{xxx} It helps think through how different factors may interface, and converge to become more than the sum of the parts (e.g. as combined air and land operations converged in *Blitzkrieg*). It also introduces a healthy humility about what can be predicted, as we cannot pre-state what the combination of existing factors may produce. That “unprestatable” will be a source of US surprise, threat and opportunity—and US specialized and integrative systems must be resilient and agile enough to take advantage.

The top-down part, which is to build and communicate a vision of where one might want to go, is in many ways the foundation of leadership at every level. At the very highest level, consider the West’s master strategy during World War Two that was shaped by four titanic figures: President Roosevelt and Prime Minister Churchill, and their respective military commanders General George C. Marshall and General Sir Alan Brooke. Each was certain they knew best how to achieve victory. Each was wrong in parts, right in others. Together they built a vision that achieved victory. And integration was key: militarily across services and with new technologies; across multiple sources of power including allies; and in the context of domestic political realities.

Yet whatever the concepts used, effective human strategists and tacticians will be crucial—and thus lastly we turn to the new science of metacognition that can help provide a cognitive edge for our new era.

Building a cognitive edge: metacognition

The Prussian General Staff's people were central to its overwhelming success against Austria in 1866 and France in 1870. And part of what made those officers so effective was to develop their self-reflection. As scholar Samuel Huntington (1957) describes, their education emphasised the development of a general understanding, and placed great stress on self-reliance, upon forming and disciplining the mind, and encouraging habits of reflection.

Huntington contrasts this to the French before the Franco-Prussian war in 1870, where individualism was rampant and the archetype was “a man of boundless courage and audacity but no reflection.” Huntington argues that these French failings were decisive in their devastating defeats by the Prussians in 1870. And this would not have surprised the ancient Chinese warrior Sun Zi (Sun Tsu) who famously wrote “If you know the enemy and know yourself, you need not fear the result of a hundred battles.”

We now know that reflection is a crucial part of how humans learn and adapt in complex environments—and the last fifteen years have seen an explosion in the scientific understanding of how humans reflect, how this arises in the brain, how it can be measured, and how to enhance it.^{xxxi} This is the field of “metacognition”, or “thinking about thinking.” Experiments have used methods like functional brain imaging and temporary brain lesions to identify key brain areas for metacognition, in particular the frontal pole that lies at the very front of the brain and is perhaps the most distinctively human brain region.

Metacognition helps to monitor and control behaviour, as well as to communicate subjective beliefs to others (e.g., “How certain are you?”). This is critical in environments with absent or sporadic feedback, characteristic of many real-world scenarios. Metacognition can also be applied to the thoughts of others, in which case it is called mentalizing.

Metacognition matters in everyday life: optimists live longer, and overconfident people achieve more at school and work. It matters in war: overconfidence is cited as a cause of conflicts, and yet who would follow a leader with no confidence into battle? Metacognition is also crucial as self-reflection can help us make wiser judgements in complex environments that require integration, to better know our own uncertainties.

Wisdom matters now because of the multiple trade-offs imposed by the multiple ways that a democracy like the United States can lose in our new era. First, it might lose a conventional war, such as over Taiwan. That needs a military capable and aggressive enough to win. Second, a conventional war could escalate to nuclear war that would likely kill, among others, millions of Americans and millions of their allies. That needs a military that can show restraint without simply losing the initiative and inviting predation. Third, protracted competition will strain democracy—and nothing matters more for democracy in the long run than the relations of the civilian and the

military.

A military that can avoid losing not just in one but in all three ways requires wisdom. How do you build a military that can avoid losing in all three ways?

Humans who better understand themselves are more likely to have the capacity—and the wisdom—to succeed in our time. And if wisdom sounds too fanciful to make real, think again. It is a foundation of the US system of government. Consider the need to reflect, to take a step back and think. George Washington saw the need to operationalize this facet of wiser decision-making. Thomas Jefferson asked Washington why they should create a Senate. "Why did you pour that tea into your saucer?" replied Washington. "To cool it," said Jefferson. "Even so," responded Washington, "we pour legislation into the senatorial saucer to cool it." A reflective second chamber, a formal opposition, a free press – such remarkable devices help a country think about its own thinking. Imperfect, to be sure, but more durable than almost all other regimes over the past two centuries. The U.S. military has built systems to look at the bigger picture, like the fabled "Office of Net Assessment" led by Andrew Marshall deep inside the Pentagon.

And how can wisdom be enhanced, or at least not lost, as the technologies of the future generate ever more data for the mind to grapple with? Consider the chain from data as a "raw material" processed into information; then on to knowledge that is ordered sets of justified enough beliefs; and then wisdom that sees the broader context for more holistic judgements.^{xxxii} Digital data is exploding, which AI now turns into information. But to win in the future will also require expert knowledge (be it military or any other single field) and new individuals and units whose role is to look across the whole as well as the parts.

It is also possible to enhance metacognition in individuals:

- Multiple studies have now shown that a simple and powerful way to improve self-awareness is to take a third person perspective on ourselves.^{xxxiii} When judging our others' work humans are often closer to reality than when judging our own work—for example when judging how long a project will take (we are often over-optimistic for ourselves and realistic for others). This is partly why formal planning can be so important, where putting your ideas down on the page enables you to better apply your own metacognition to them. It also explains why advisors can be so crucial—Churchill during World War Two deliberately chose his Chief of General Staff a man (General Brooke) who would stand up to him, and it is also notable that von Moltke's Prussian General Staff in the Franco-Prussian war were advisors rather than the ultimate decision-makers in each army. Being forced to make our knowledge public by explaining things to others is valuable as it is easier to recognize when others are saying things that are nonsense than ourselves. "Read, write, fight" was the call by a recent Chief of Naval Operations.^{xxxiv} It is also notable that many of these techniques are easier in democracies than authoritarian states like China, and should be harnessed as a potential cognitive edge.
- Metacognition can help learning. A recent Harvard Business School study, for example, compared groups of trainees at the Indian IT company Wipro.^{xxxv} They could either spend the last 15 minutes of their day either

reflecting on what they had learned (the reflection condition), explaining the main lessons to others (the sharing condition), or continuing their studies as normal (the control condition). Both the reflection and sharing conditions boosted performance by over 20% compared to control.

- More direct methods can also enhance metacognition. These include including applying a weak electrical current to the prefrontal cortex (a technique known as transcranial direct current stimulation).^{xxxvi} The drugs Ritalin and beta-blockers have both been shown to boost metacognition.^{xxxvii} Japanese researchers have shown it is possible to train people to directly alter the brain circuits that track confidence in their decisions whilst undergoing brain scanning.^{xxxviii}

Understanding human metacognition at the level of computations in the brain is also key for another area: the human-AI teams that now often beat both humans or machines alone in many tasks. These human-machine teams require teamwork. But how can humans and machines communicate to make good decisions together? Understanding the human brain's computations tells us how machines can become better team players, by communicating in ways humans use. For example metacognition is important for communication in teams (Bahrami et al., 2010; Frith, 2012), such as when communicating confidence (e.g. noting how confident each team member is when making estimates). Computational approaches will help construct a human-machine lingua franca, one more understandable to both and that can help make more effective decisions.

The Prussian General Staff was created because military genius is scarce, so they instead sought to make the talented non-genius into a better expert decision-maker. In our era, we can recognise the similar scarcity of wisdom, and forge the wiser decision-makers required for effective integration.

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ⁱ <https://media.defense.gov/2022/Mar/28/2002964702/-1/-1/1/NDS-FACT-SHEET.PDF>

ⁱⁱ For further details on the AFOE project, please contact www.intelligentbiology.co.uk. See also <https://media.defense.gov/2022/Mar/28/2002964702/-1/-1/1/NDS-FACT-SHEET.PDF>.

The development of the Joint Concept for Campaigning is noted in <https://www.armed-services.senate.gov/imo/media/doc/FY2023%20NDAA%20Executive%20Summary.pdf>

ⁱⁱⁱ For a classic and accessible summary see e.g. (Grant, 1978), particularly Chapters 10 and 11.

^{iv} For a classic discussion of civil-military relations see e.g. (Huntington, 1957). It was published reasonably early in the Cold War and is thus also relevant as in 2022 we are early in our new global competitive era that started around 2014.

^v Here I focus on integration that more directly affected strategic power, particularly as it affected warfare. For a discussion of economic integration and globalisation see e.g. Wright (2019) *Global strategy amidst the globe's cultures*. Downloadable at www.intelligentbiology.co.uk.

^{vi} The idea of a military revolution was put forwards by (M. Roberts, 1956), and although vigorously debated has considerable support, e.g. Chapter 2 in (Paret et al., 1986). On JADC2 see e.g. (Hoehn, 2021).

^{vii} On France, e.g. (Howard, 1976; Kennedy, 1988). On Chinese civil military fusion see e.g. (Bitzinger et al., 2021; Kania & Laskai, 2021). On US responses, see Wright ND (2021) *The future character of information in strategy: forged by cognition and technology*, Intelligent Biology. Downloadable at www.intelligentbiology.co.uk.

^{viii} See Wright (2019) *Global strategy amidst the globe's cultures*. Downloadable at www.intelligentbiology.co.uk.

^{ix} See e.g. (Howard, 1976, pp. 79–82)

^x See Chapter 6 in (Howard, 1976), Chapter 11 in (Paret et al., 1986), Chapter 8 in (Freedman, 2013).

^{xi} See (MacMillan, 2014, Chapter 12) and (Clark, 2013, p. 531).

^{xii} (MacMillan, 2014, pp. 322–323)

^{xiii} (Gompert et al., 2014, Chapter 5)

^{xiv} For a broad history over the twentieth century see e.g. Wright ND (2022) *Neither triumph nor disaster: United Kingdom responses to Covid-19 and the future of national security*, PRISM, National Defense University Press, US. For a discussion of World War Two see e.g. (A. Roberts, 2008).

^{xv} (Posen, 1984) and (May, 2000) provide good discussions comparing Germany and France in this period, which includes integration.

^{xvi} For discussions of the whole period 1942 until 1991 see (Rearden, 2012).

^{xvii} In addition to (Rearden, 2012), for a discussion of Goldwater-Nichols see e.g. (McInnis, 2016).

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- xviii The post-Cold War US military has been excellent at Joint operations, as shown in the Gulf War in 1991 or Operation Iraqi Freedom in 2003. How hard jointness can be is also shown in the comparison with Russia's problems in Ukraine in 2022.
- xix The first quote from David Shambaugh and the quote from Xi Jinping are from https://www.washingtonpost.com/world/asia_pacific/in-china-soviet-unions-failure-drives-decisions-on-reform/2013/03/23/9c090012-92ef-11e2-ba5b-550c7abf6384_story.html. The quote on comprehensive national power is from (Shambaugh, 2013, p. 6). See also (Shambaugh, 2013, p. 274). On the military see e.g. (Blasko, 2012). On integrating across multiple sources of power see e.g. Chapter 5 in (Kilcullen, 2020). The RAND report discussed is (Scobell et al., 2020).
- xx See e.g. (Lewis & Litai, 1999) and (Cliff et al., 2011)
- xxi (Cheng, 2011)
- xxii (Kilcullen, 2020)
- xxiii (Blasko, 2012, p. 18)
- xxiv (Scobell et al., 2020)
- xxv (Scobell et al., 2020)
- xxvi This date is taken from Wright (2019), v2, *Mindspace: cognition and space operations* (www.intelligentbiology.co.uk).
- xxvii For discussion and practical applications see Wright (2021) *The future character of information in strategy: forged by cognition and technology*, Intelligent Biology. Downloadable at www.intelligentbiology.co.uk
- xxviii (Freedman, 2013, p. 611)
- xxix Introduced in (Kauffman, 1996, 2000), but see the references immediately below for more accessible and applied descriptions.
- xxx For recent application for SMA to national security see: https://nsiteam.com/social/wp-content/uploads/2021/06/Invited-Perspective_Escalation-Management-in-IO_FINAL.pdf. See also (Hunt et al., 2020). The definition is from (Björneborn, 2020).
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- xxxiii (Fleming, 2021, pp. 130–132)
- xxxiv (Richardson & O'Keefe, 2016) Admiral John Richardson wrote as Chief of Naval Operations. Download at <https://www.usni.org/magazines/proceedings/2016/june/now-hear-read-write-fight>
- xxxv (Di Stefano et al., 2021)
- xxxvi (Harty et al., 2014)
- xxxvii (Hauser et al., 2017; Hester et al., 2012; Joensson et al., 2015)
- xxxviii (Cortese et al., 2016, 2017)